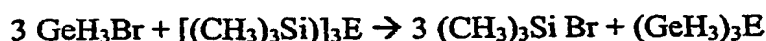


**WHAT IS CLAIMED IS:**

1. A method for synthesizing a compound having the formula  $E(\text{GeH}_3)_3$  wherein E is selected from the group consisting of arsenic (As), antimony (Sb) and phosphorus (P), the method comprising combining  $\text{GeH}_3\text{Br}$  with  $[(\text{CH}_3)_3\text{Si}]_3\text{E}$  under conditions whereby  $E(\text{GeH}_3)_3$  is obtained.
2. The method of claim 1 further comprising purifying the obtained  $E(\text{GeH}_3)_3$ .
3. The method of claim 1 wherein the step of purifying the obtained  $E(\text{GeH}_3)_3$  comprises trap-to-trap fractionation.
4. The method of claim 1 wherein  $E(\text{GeH}_3)_3$  is obtained with a yield from about 70% to about 76%.

5. A method for synthesizing a compound having the formula  $E(\text{GeH}_3)_3$  wherein E is selected from the group consisting of arsenic (As), antimony (Sb) and phosphorus (P), the method comprising combining  $\text{GeH}_3\text{Br}$  with  $[(\text{CH}_3)_3\text{Si}]_3\text{E}$  to obtain  $E(\text{GeH}_3)_3$  according to the formula:



6. The method of claim 5 further comprising purifying the obtained  $E(\text{GeH}_3)_3$ .
7. The method of claim 5 wherein the step of purifying the obtained  $E(\text{GeH}_3)_3$  comprises trap-to-trap fractionation.
8. The method of claim 5 wherein  $E(\text{GeH}_3)_3$  is obtained with a yield from about 70% to about 76%.
9. A method for doping a region of a semiconductor material in a chemical vapor deposition reaction chamber, the method comprising introducing into the chamber a gaseous precursor having the formula  $E(\text{GeH}_3)_3$ , wherein E is selected from the group consisting of arsenic (As), antimony (Sb) and phosphorus (P).
10. The method of claim 9 wherein the semiconductor material comprises silicon (Si).
11. The method of claim 9 wherein the semiconductor material comprises germanium (Ge).

12. The method of claim 9 wherein the semiconductor material comprises SiGeSn.
13. The method of claim 9 wherein the semiconductor material comprises SnGe.
14. A method for depositing a doped epitaxial Ge-Sn layer on a substrate in a chemical vapor deposition reaction chamber, the method comprising:
  - introducing into the chamber a gaseous precursor comprising  $\text{SnD}_4$  mixed in  $\text{H}_2$  under conditions whereby the epitaxial Ge-Sn layer is formed on the substrate; and
  - introducing into the chamber a gaseous precursor having the formula  $\text{E}(\text{GeH}_3)_3$ , wherein E is selected from the group consisting of arsenic (As), antimony (Sb) and phosphorus (P).
15. The method of claim 14 wherein the gaseous precursor is introduced at a temperature in a range of about  $250^\circ\text{C}$  to about  $350^\circ\text{C}$ .
16. The method of claim 14 wherein the substrate comprises silicon.
17. The method of claim 14 wherein the silicon comprises Si(100).
18. The method of claim 14 wherein the Ge-Sn layer comprises  $\text{Sn}_x\text{Ge}_{1-x}$  and x is in a range from about .02 to about .20.
19. A method for forming a Group IV semiconductor film, the method comprising
  - forming the Group IV semiconductor by a chemical vapor deposition method, said Group IV semiconductor film being doped with impurities at a concentration ranging from about  $10^{21}$  atoms/ $\text{cm}^3$  to about several percent, the impurities being selected from the group consisting of arsenic (As), phosphorous (P) and antimony (Sb).
20. A method for forming a Group IV semiconductor film, the method comprising:
  - forming the Group IV semiconductor film by a chemical vapor deposition method; and
  - while forming the Group IV semiconductor film, doping the film with impurities at a concentration ranging from about  $10^{21}$  atoms/ $\text{cm}^3$  to about 3 at. %, the impurities being selected from the group consisting of arsenic (As), antimony (Sb) and phosphorus (P)

21. The method for forming a Group IV semiconductor film according to claim 20, wherein arsenic (As), antimony (Sb) and phosphorus (P) are added to the Group IV semiconductor film by diffusion methods.
22. The method for forming a Group IV semiconductor film according to claim 20, wherein said doping step comprises introducing the As, P, or Sb impurities into a reaction chamber as hydride compounds, together with at least  $\text{SnD}_4$ ,  $\text{GeH}_4$ ,  $\text{Ge}_2\text{H}_6$ .
23. A method of preparing  $(\text{E})\text{H}_x(\text{GeH}_3)_{3-x}$ , where  $x=1$  or  $2$  and E is selected from the group consisting of P, As, Sb, the method comprising reacting inorganic or organometallic compounds of the E element with an alkali germynyl or a halogenated germane.
24. The method of preparing  $(\text{E})\text{H}_x(\text{GeH}_3)_{3-x}$  according to claim 23 wherein the alkali germynyl comprises  $\text{KGeH}_3$ .
25. The method of preparing  $(\text{E})\text{H}_x(\text{GeH}_3)_{3-x}$  according to claim 23 wherein the halogenated germane comprises  $\text{BrGeH}_3$ .